These slides with links: https://cutt.ly/BeModeLS-Overview-2023



BeModeLS:

Behavioural Models of Land Systems

Working Group Overview



Land Systems as the nexus for sustainability



GLP mission, overall goals, and objectives 1–4 <u>de Bremond (2021)</u>

Models to represent diverse behaviour

- Alternatives to rational actor & equilibrium-based models
- Diverse actors, activities & behaviours \bullet and their interactions
 - including with physical environment 0

Across...

- local to global scales: \bigcirc
- individuals to institutions levels: \bigcirc
- distances: short to long \cap

More detail in AIMES Bulletin (Issue 1): https://aimesproject.org/bulletin/

WORKING GROUP: BeModeLS

Behavioural Models of Land Systems



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Behavioural Models of Land Systems (BeModeLS) is a joint working group between AIMES and the Global Land Programme that aims to support and build interdisciplinary collaboration across the scientific disciplines represented by these global research networks. The group welcomes a wide range of perspectives and members with interests in building any aspects of human behaviour (e.g. individual, collective, and organisational) in land systems models and its interactions with other land system processes.

Models? Human activity influences Earth systems in myriad ways, from agricultural choices causing soil erosion and water chemistry imbalances, to forestry management decisions modifying carbon emissions and biodiversity, to energy policy designs that shape the progress of climate change mitigation actions. But representation of such influences in Earth System Models (ESMs) is currently limited to broad generalisations of activity through use of scenarios of possible economic and societal trajectories. For example, the Shared Socioeconomic Pathways in the IPCC Sixth Assessment Report provide narratives of possible climate change mitigation

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Why do we need Behavioural

and adaptation actions that have subsequently been quantified to explore likely biophysical responses in the Earth system, such as climate change (Riahi, et al. 2017). These scenarios are quite limited in the spatial differentiation of socioeconomic outcomes (O'Neill et al. 2020) and because they are exogenous to ESMs they provide no scope for representing humanenvironment feedbacks or adaptation of human activity to changing conditions (Donges et al. 2020). Furthermore, such approaches including the Integrated Assessment Models used to turn the qualitative narratives into quantitative values for input to other models - assume a anyway? specific model of economic theory in which human behaviour is narrowly

rational and maximising. And vet, empirical observations have frequently shown how human decision-making deviates from this perfectly economically rational model (Schlüter et al. 2017), Humans are inherently adaptable with the potential to respond to stimuli in far more creative and inventive ways than standard economic models allow for. The inability to represent the great diversity of human behaviours in ESMs is a shortcoming that limits our understanding of the range of possible global outcomes over the coming decades.

What are Behavioural Models,

A key aim of the Behavioural Models of Land Systems (BeModeLS)

Modeling Approaches	Description	Strength	Weakness	References
Agent-based models	Disaggregated representation of actions and interactions of individuated actors	Flexibility allows different aspects of behaviour to be examined (e.g. maximising vs 'satisficing')	Potentially great data demands and large number of parameters to estimate	Filatova et al. (2013), Dressler et al. (2019), Heppenstall et al. (2020)
System Dynamics	Aggregated representation of flows and stocks of resources	Enables clear focus on flows and feedbacks of energy, goods and information	Requires 'stocks and flows' approach which may constrain representation of behaviour	Warner et al. (2013), Berrio-Giraldo et al. (2021)
Bayesian belief networks	Graph-based representation of conditional dependencies between components	Probabilistic representation and potential for automated specification of network structure	Representation of spatial dependencies and interactions can be challenging	Landyut et al. (2013), Andriatsitohaina et al. 2020
Conceptual models	Formal description of a system, often in diagrammatic form, to aid communication and theorising	Forces pre-specification of elements to be modelled prior to data collection and analysis	Relies on other modelling approaches for analytical, quantitative or computational implementation	Alberti et al. (2011), Gaughan et al. (2019)

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defined as (perfectly) economically

Table 1. Examples of behavioural modelling approaches used for investigating human activity in Earth systems

A Range of Approaches

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Table 1 from Millington et al. (2023) https://issuu.com/aimesproject/docs/aimes_bulletin_11jan23/7

Agent-Based Modelling (is one approach)



Elements of a possible agent-based model at the landscape-scale. Ford et al. (2021)

System Dynamics, BBNs, others...



Simplified causal loop diagram of the dynamics of change of land cover and land use of the Río Grande basin Berrio-Giraldo *et al.* (2021)

Modelling for a range of purposes





Working Group Aims

- 2. Support construction of a *library* of models and code
- 3. Motivate development of common *data* to compare models
- 4. Foster use of *social science theories*, insights for modelling
- 5. Stimulate experiments that use and *compare models*
- 6. Encourage design/implementation of new models of *institutions*
- 7. Push for modelling of collective actions influencing *individuals*
- 8. Catalyse exploration of impacts of *environmental change*
- 9. Promote identification of best targets for *policy* levers
- 10. Support the development of *theories of land system change*
- 11. Push coupling of behavioural models with *earth system models*

Contribute

- 1. Foster an inclusive, active, diverse and cooperative community of social-ecological land system modellers
- What would you like the group to do?
- What is missing from the aims?
- What aims, topics, themes should we prioritise?
- How can the group help you with your research?
- How do we compare/couple models?

Breakout Rooms

Add notes on slides at: https://cutt.ly/BeModeLS-Breakout-2023-02



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